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TUNG CULTURE IN THE GULF COAST REGION*

RUBEN L. PARSON
State Teachers College
Troy, Alabama

INTRODUCTION

In our present era of crop surpluses arising from faulty distribution and other economic ills, consideration of a crop commodity for which demand far exceeds supply might well refresh the most casual observer. Tung oil belongs to the limited group of plant materials not yet produced in sufficient amounts to approach satisfaction of world requirements. So extremely deficient is the supply of tung oil that American industries alone would use much more than the world produces if sources were reliable and prices reasonable.

Tung oil belongs to the particular kind of vegetable oils designated in commerce and industry as drying oils—oils which, when applied to certain materials, dry quickly, leaving a hard, more or less impermeable coating adhering to the surface. Unlike various other vegetable oils, such as peanut and cottonseed, tung cannot be used for food. However, its superior quality as a drying oil alone is quite adequate recommendation.

Since its acceptance by Portuguese traders in Canton as early as 1516, tung oil has become increasingly prominent in foreign commerce.

INDUSTRIAL USES OF TUNG OIL

Since ancient times the Chinese have used tung oil for many different purposes. Marco Polo reported the use of China wood oil for calking boats and ships. Many wooden idols have survived

* Factual information in this article came largely from Mr. J. C. Adderley, for several years President of the American Tung Oil Association and from Dr. C. C. Concannon, Chief, Chemical Division, Bureau of Foreign and Domestic Commerce.

the ages under protective coatings containing tung oil. It serves as an ingredient in leather dressing, and as a waterproofing for a great variety of materials, including textiles and clothing. It illuminates many Chinese homes.

Tung ranks as an essential raw material in modern industry. In the manufacture of paint, varnish, enamel, and lacquer, nothing rivals tung oil, because it dries more quickly and leaves a more durable film than any other paint ingredient. Paint and varnish industries consume about two-thirds of United States imports, and their consumption is severely curtailed because of inadequate supply. Substantial amounts enter into the manufacture of linoleum, oil cloths, printing inks, brake linings, gaskets, et cetera. Extensive and varied uses for waterproofing, insulating, protecting, and preserving materials and finished goods further magnify the services of tung oil. It plays an important rôle in the manufacture of plastics, such as pressed wood; and experiment may determine certain medicinal values it is believed to possess.

CHINA—PRINCIPAL PRODUCER

Altho China holds undisputed supremacy in tung oil production, systematic cultivation of the tung tree in that country began only a few years ago in response to a growing market and the modern scientific movement in Chinese land economy. The tung trees which secured for China virtual monopoly in tung oil grew mainly on waste land prohibitive of agriculture, under semi-wild conditions. They contributed to the meagre cash income of Chinese farmers; but pressure on arable land for food to sustain a redundant population excluded them from cultivation. During the last decade, however, the National government and those of various provinces concerned have encouraged (even compelled) farmers to plant tung groves. Several large commercial plantations have also developed. Rapid progress continued until Japanese aggression interrupted China's economic reconstruction.

About the tributaries of the Yangtze Kiang in the interior of South China lies the one great source of tung oil in the world. Currently the provinces of Szechwan (leading producer) and Hunan, contribute nearly a third of the output. Substantial amounts come from Hupeh, from Chekiang and Kiangse districts to the east, and especially from Kwangsi in the south, which province lies beyond the Yangtze Valley in the drainage basin of the Si Kiang. Chinese production increased from 44,000 tons in 1914 to 138,000 tons in

1938, reflecting definite, tho delayed, response to a strong market since the World War.

China exports about three-fourths of its production. Normally, the oil goes by boat down the Yangtze Kiang to Hankow and Shanghai; down the Si Kiang to Canton and Hong Kong. However, Japanese invasion has deranged established transport systems, at least temporarily, forcing overland shipment of the Yangtze product to southern ports. Hankow maintains its rank as the world's greatest concentration center and primary market for tung oil, a position secured by strategic commercial location. Shipments from the upper Yangtze focus on Hankow; and during seasons of high water (summer) ocean vessels meet them there, some 600 miles from the sea.

UNITED STATES—CHIEF MARKET AND CONSUMER

Tung oil from China travels to all parts of the world, but the bulk of it goes to the United States and Europe. United States alone buys about three-fourths of the export product, of which only minor quantities are re-exported. First considerable importation into the United States of record came in 1861, when Yankee clippers brought 138,635 pounds. The American trade attained prominence during the active industrial period following the World War.

New York, San Francisco, and Seattle handle most of the American import, amounting in 1937 (peak year to date) to almost 175,000,000 pounds valued at $20,000,000, nearly one-fifth of our total imports from China.

DOMESTIC SUPPLY DESIRED

Dependence upon a remote, foreign source for an essential raw material is conducive to industrial stability and security only in the degree to which the supply remains constant and available. American consumers of tung oil (utilizing about 65 per cent of the world production) face world competition for a raw material characterized by excessive variability in quantity, quality, and price. Usually, available supply is entirely inadequate, the quality low, and the price exorbitant. (Tung oil has sold for as much as 44 cents per pound.) These circumstances compel paint and varnish manufacturers to use a minimum of tung oil in their formulations, with larger amounts of others, such as linseed, perilla, soybean, and oiticica. In high grade products they *must* use some tung oil. Diligent search for a material to replace it or a process by which it

might be eliminated has not yet succeeded. Many small manufacturers are unable to secure enough to satisfy even minimum requirements.

Under conditions of general world unrest, particularly with Japanese penetration into the producing area, our need for a domestic supply of tung oil becomes increasingly critical. The war in China will materially reduce production; and the Japanese are already diverting available supplies into new trade channels. Japan has begun development of a great paint and varnish industry based on Chinese tung oil. Thus, our foreign source of this essential raw material may be closed to us.

American consumption would probably double or treble if a reliable domestic supply were developed. Our present consumption ranges between 100 and 150 million pounds per year. To satisfy our own market we might need 1,000,000 acres of producing tung trees.

THE TUNG TREE AND ITS HABITS OF GROWTH

Two members of the spurge family (Euphorbeaceae), *Aleurites fordii* and *Aleurites montana* yield the tung oil of commerce. The *montana,* adapted to the tropics, dominates in the southern Chinese area and shows some promise in lower latitudes. The *fordii,* more hardy and prolific, flourishes in the subtropical to warm temperate zones, including southeastern United States.

Fig. 1. Year-old tung seedling north of Pensacola, Florida. Early pruning ensures desirable tree form. Clean trunk and elevated crown offer little obstacle to cultural operations, prevent injury by range animals, and reduce frost hazard by permitting free flow of air under the branches.

Aleurites fordii, superior American producer, merits brief description in this presentation. The tree grows rapidly, especially during youth, attaining the height of a man in less than a year after germinations of the seed (Fig. 1). At maturity it reaches a height of 25 feet or more, with a canopy more than thirty feet in diameter (Fig. 2). From the main stem numerous branches curve upward and outward producing a close, more or less umbrella-like canopy. A

smooth, thin, gray-green bark covers the tough amber-colored wood.

The tree produces a heavy foliage of large, glossy leaves, dark-green in color, and roughly heart-shaped, tho many have three points instead of one. Being deciduous, the tree sheds its leaves in autumn, standing gray and bare thru the winter.

Spring sunshine (March) brings forth a profusion of blooms in large cymes, each blossom white with red streaks in its throat, its petals exceeding an inch in length. The flowers are unisexual, but both pistillate and staminate blooms grow on the same tree (monoecious), assuring complete pollination. Like the flowering dogwood (Cornus florida), the tung tree blooms before it foliates.

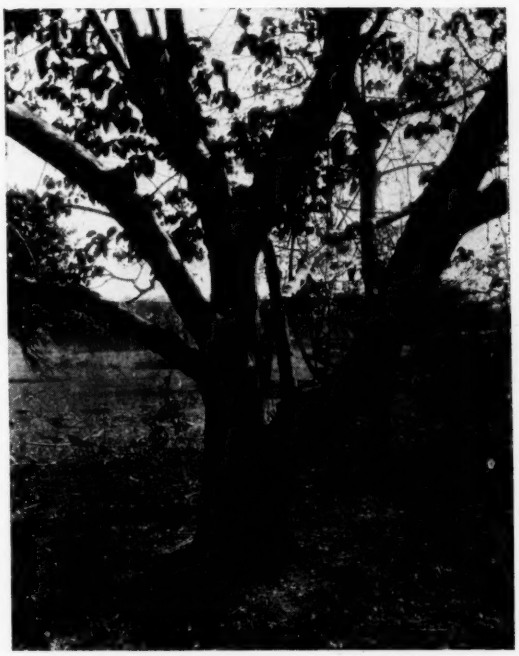


Fig. 2. Large tung tree in the famous Barbeau grove near Mobile, Alabama—32 years old—41 feet tall—45-foot canopy—trunk circumference, 74 inches. This patriarch produced 342 pounds of nuts in one year. *Courtesy J. C. Adderley.*

After a few days the blooms fade and drop off, leaving tiny, green pellets in their places, the beginnings of fruit destined for varnish. The globular nuts resemble green apples during growth, but hang on longer stems. As they mature their color changes from dark-green to reddish-brown. They attain a size of 2 to 3 inches in diameter. The outer husk normally hides five large kernels (in many cases 4, 6, or 7), which contain the oil (Fig. 3). When the nuts ripen (November) they drop off the tree; and they may lie on the ground for weeks without injury.

CLIMATIC REQUIREMENTS

Climatic requirements restrict Aleurites fordii to humid subtropical regions characteristic of east margins of continents under 30° latitude on both sides of the equator. Thus, its distribution

approximates the belts of subtropical high pressure, the horse latitudes. The American Tung Belt, delimited climatically, includes northern and western Florida, southern Georgia, Alabama, Mississippi, and Louisiana, and southeastern Texas, extending from the coast inland about 100 miles.

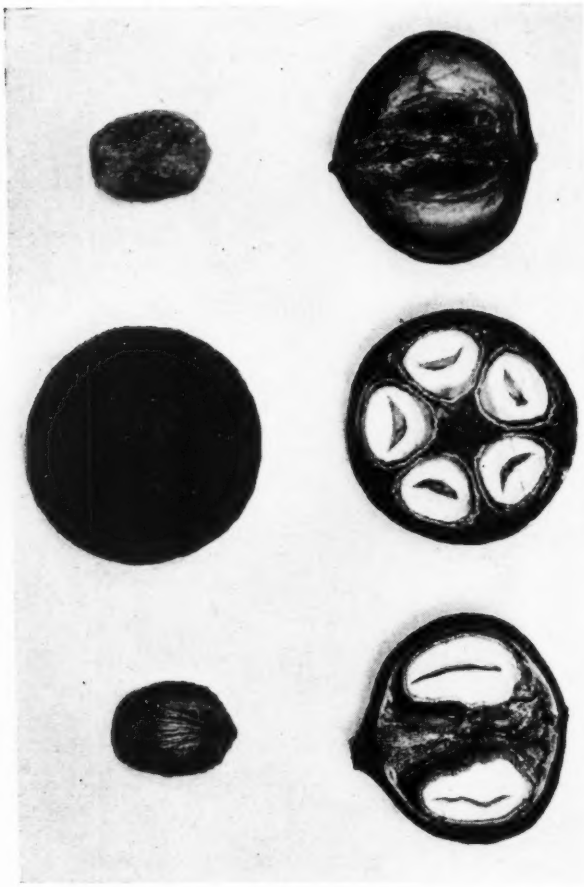


Fig. 3. Above: whole tung nut and two seeds or kernels. Below: cross sections showing arrangement of seeds within several coverings. Seeds are removed from the husk for planting.

The tree can survive considerable drought, but thrives best when rain falls regularly as well as abundantly. It needs a long growing season with uniformly high temperatures; and, for health and production, it needs winter temperatures low enough to enforce three-months' dormancy. Premature warmth in spring which swells the fruit buds, and subsequent frost which injures buds or blooms constitute a serious hazard. Late frosts cause frequent crop failures which might profitably be guarded against by smudging in highly productive groves. Severance of lateral roots to a depth of six inches or more (easily accomplished with a disc harrow), when the tree defoliates in autumn prevents excessive stimulation by a few unseasonably warm days in early spring. In mature groves a good grass cover or mulch serves the same purpose. Under-

nourished trees may be killed by winter cold, but healthy ones endure temperatures near zero Fahrenheit without injury.

SOIL AND DRAINAGE REQUIREMENTS

Tho peculiarly partial to acid soils with good capacity for holding moisture, the tung tree will tolerate neither excess acidity nor standing water. Many groves have failed because they were planted on highly acid soils without application of lime. Others planted on relatively low, flat land have flourished for several years and promptly died when the roots reached a zone of saturation. The trees should not be planted where the water table lies less than twenty feet below the surface; so deeply do they root. Excessive moisture subjects the roots to ravages by a fungus which ultimately kills the entire plant.

Besides the root fungus just mentioned one other disease develops in the tung tree to a degree seriously detrimental, namely chlorosis caused by malnutrition. Discoloration or shriveling and malformation of the leaves evinces a chlorotic condition resulting from inadequate supply of essential plant foods available to the tree. Thus, diseases of the tung tree simply manifest physiologic maladjustments, inadequate water drainage or unsatisfactory soil conditions. Possessed of peculiar insecticidal powers, the tree protects itself against insect pests, obviating all need for spraying.

Soils best suited to tung culture occupy relatively high, gently sloping areas. Acidity exceeding the degree indicated by a pH value of 5.5 needs correction by liming to insure satisfactory growth. A considerable humus content is desirable. Neither extremely coarse nor very fine textures are suitable; colloidal material should constitute at least 30 per cent. Moderately heavy, permeable subsoils with good water-retaining capacity are most satisfactory. Soils with hard-pan development or indurated sub-strata obstructing downward percolation of water must be avoided, unless the condition may be readily remedied.

Good grades of Orangeburg, Tifton, Norfolk, Ruston, Greenville and other upland series are well adapted to tung culture.

DEVELOPMENT OF A GROVE

Commercial tung culture is a 20th Century enterprise, about which much remains to be learned. However, continuous experimentation in the United States since introduction of seed from

China as early as 1904 has yielded enough practical information to raise the industry above the exploratory stage. Prevailing notions to the contrary notwithstanding, tung culture for commercial production involves careful planning and constant attention.

Most critical, perhaps, is the selection of land with suitable soil, and slope (12 per cent or less) conducive to soil and water conservation. New ground, usually superior to crop land in organic content and other essentials, must be cleared of trees and stumps prior to planting. Worn crop land needs preliminary re-conditioning with legumes and fertilizer. Terracing according to contour should be initiated before, or incidental to planting. Selection of nursery stock, proper planting and spacing of the seedlings (25 to 30 feet apart), and thoro weeding about the young trees are all vitally important operations. Thoro cultivation between the rows, with frequent sowing of legumes, is recommended procedure in young groves (Fig. 4).

Fig. 4. Newly planted tung grove on Norfolk fine sandy loam a few miles north of Pensacola. Crotalaria—superior summer legume—shades the ground against scorching summer sunshine, enriches the soil, prevents accelerated erosion, conserves water, and yields a valuable crop of seed.

Pruning and forced branching to shape the trees properly must not be neglected. Several prunings may be necessary during the first year alone, the ultimate objective straight, clean trunks with thick, symmetrical crowns beginning several feet above the ground.

Maintenance of soil fertility is a major problem because tung trees require much food for normal growth and fruiting. Undernourished trees produce few nuts and freeze easily. They are also subject to chlorosis—"starvation" in disguise. Certain salts of zinc or manganese may correct a chlorotic condition, acting primarily as catalysts rendering available plant foods previously unobtainable. But, since nothing comes whence it has not been, this catalytic process loses effect after it has released the whole supply of nutriments. Then, indeed, the plant must starve; neither zinc nor manganese can sustain it. Only by maintaining in the soil at least 2 per cent of organic material, 100 pounds of phosphoric

acid and 50 pounds of available potash per acre can tree health and production be assured.

Year-old seedlings, transplanted in a grove during February, will normally yield an economical crop three or four years later. Operations prior to increment determine the ultimate success of a development. Their cost, far exceeding the price of land, must be counted part of the capital investment. After the first crop, yields increase for ten years or more and then slowly decline. The productive life of a tree can only be conjectured, because the industry is too young; but trees more than thirty years old are yielding abundantly.

HARVESTING AND PROCESSING

When all the nuts have fallen (mid-December) harvesting consists simply of raking them into piles, loading them onto a wagon or truck, and hauling them to the mill. In clear autumn weather they dry sufficiently in piles on the ground; but in a rainy season they require temporary storage in well-ventilated bins to reduce moisture content enough for satisfactory milling. Water discolors and otherwise reduces the quality of the oil.

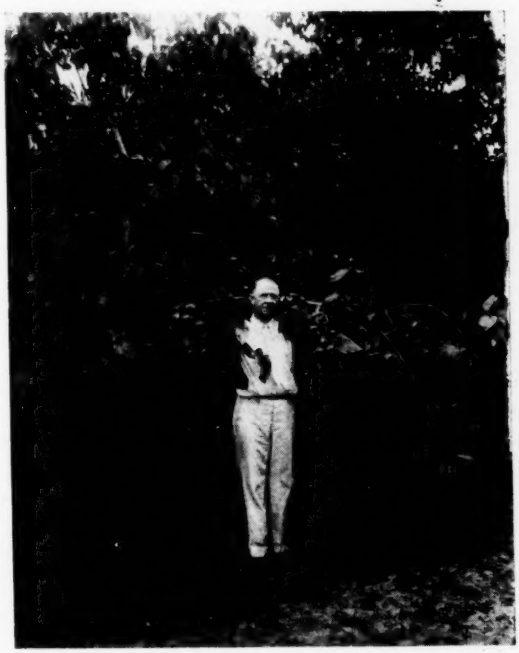


Fig. 5. Cluster type tung tree, six years old, bearing a good crop of fruit. Exhibited by Mr. J. C. Adderley, President, Tung-Empire Corporation, Pensacola, Florida.

Groves in good production, with 50 to 60 trees per acre, yield more than 100 pounds of nuts per tree in a favorable year (Fig. 5). However, frost damage occurs so frequently that average annual production may fall far below that amount.

Expression of the oil involves three distinct machine operations:

1. Hulling or decortication to separate seeds from husks.
2. Crushing or grinding the seeds into meal.

3. Pressing the meats or meal to expel the oil.

Merchant milling costs about $5.00 per ton of nuts. Nuts delivered at the mill sold for $30.00 per ton in 1938.

Products from processing 100 pounds of dry fruit approximate 20 pounds (2½ gallons) of oil, 20 pounds of press cake, and 60 pounds of hulls and shells. The oil travels to market in steel drums or tank cars, a far cry from tin cans and baskets on the Yangtze Kiang. Average price of the oil during the last 20-year and 40-year periods has been about 15 cents per pound. By economical development production costs may be reduced to 5 cents per pound.

The press cake (pomace) has fertilizer values almost equivalent to those of cottonseed meal, with the additional advantage of insecticidal properties. Exceedingly purgative and otherwise injurious to animals, it has no utility as a stock food. It may sell for $15.00 per ton. The hulls, rich in potash, are useful as compost or mulch.

TUNG CULTURE IN SOUTHERN LAND ECONOMY

The American Tung Belt includes a substantial portion of the cut-over pine region which constitutes a major Southern problem. Its weathering ghost towns silently condemn exploitive lumbering, which left isolated settlement, submarginal agriculture, tax delinquency, and rural poverty to obstruct progress. But, an abundance of cheap land with few occupants invites the tung industry to salvage what others laid waste.

Fig. 6. Volunteer pine seedlings (longleaf and slash) on land purchased for tung development south of Hattiesburg, Mississippi. Thousands of acres like these invite combination of tung culture and forestry on the rolling, sandy hills of the Gulf Coastal Plain. *Courtesy Dixie Tung Oil Development Company, Jackson, Mississippi.*

Peculiar attributes commend tung for a prominent place in the land economy of the South. Its climatic requirements restrict it to the South, precluding the possibility of domestic competition. Thus secured, it merits special consideration among cash crops to replace or supplement cotton. Confined locally to relatively high situations, it encourages re-

forestation of interposing lowlands, especially under large-scale corporate development with sufficient capital to apply intelligent land planning. The extreme sensitivity of the tung tree to fire lends increased significance to forest fire control, and discourages, the destructive practice of burning range land to improve grazing.

Plantation developments by well-financed corporations replace tenantry with supervised labor, demonstrate the feasibility of diversified farming, and project long-range integration of crop agriculture, forestry, and grazing. Large tracts of land admirably adapted to a combination of tung culture and forestry have good stands of young pine (slash and longleaf) already growing (Fig. 6), needing only protection against fire and over-grazing to yield rich returns in timber and naval stores a score of years hence. After a few years of cultivation (10 or less) the groves may be sown to clovers and grasses. Both forest and groves may be pastured judiciously with benefit rather than injury. A grass cover does not prevent application of fertilizers; it facilitates gathering of the nuts. By combining three land-use enterprises the industry escapes the hazards of a one-crop economy, furthering agricultural prosperity by example as well as by increased production of wealth. Private land owners simulate the practice, thereby fortifying themselves against vagaries of climate and market with diverse sources of income.

PROGRESS AND PROSPECT

Since commercial planting of tung trees began in the Gulf Coast Region about 1923, the American industry has expanded rapidly. In 1938 tung groves covered an estimated area of 175,000 acres; but experts predict that one-half the acreage will fail because of poor location, improper planting and development, or sheer neglect. Planting progresses apace, much of it scientifically done, on an elaborate scale. Many corporations operate on tracts of land several square miles in extent, with enormous capital investment. Increasing development of small groves to bolster farm incomes promises wide distribution, with organization for co-operative marketing.

In 1928 the first modern, mechanical plant for expressing tung oil was built at Gainesville, Florida; and in 1932 the first commercial shipment of the domestic product left that place. As production expanded, mills were built at Brooker, Florida, Cairo, Georgia, Citronelle, Alabama, Lucedale and Picayune, Mississippi, Bogalusa and Covington, Louisiana; and others are contemplated. Domestic

production of the oil approximated 3,000,000 pounds in 1938.

A few forward-looking individuals pioneered the American tung oil industry, often at great personal expense. For several years the Experiment Station at Gainesville, Florida, and the South Mississippi Experiment Station at Poplarville have engaged in scientific experimentation to improve cultural practices. During the last year the Bureau of Plant Industry established stations for special research on tung at Cairo, Georgia, Bogalusa, Louisiana, and Gainesville, Florida, assisted by the Bureau of Chemistry and Soils. Federal assistance lends increased stimulus and assurance to the industry.

In a single decade of commercial production the Gulf Coast Region has created a new American industry. In another decade that region may render the United States independent of foreign sources for tung oil despite increased consumption as domestic supply becomes available.

However, American production in excess of home demands may meet keen competition in the world market. Coincident with American development planting has been done in many parts of southern Asia and Oceania, in Africa, and in east-central South America. Several areas show good possibilities. The South American region, which includes portions of northern Argentina, southern Brazil, Uruguay, and Paraguay, possesses great potentiality and may eventually become prominent in tung oil production and export. Meanwhile, the Gulf Coast Region of the United States, with superior organization and facilities, ranks second only to China in volume of product and bids fair to attain pre-eminence as a source of tung oil.

MAKING GEOGRAPHY TEACHING CLICK

W. C. LUCAS
Thirty-first-Street School, Milwaukee, Wisconsin

A college professor once remarked to his class that he knew a teacher who could teach Greek and make of it a series of thrilling, breath taking experiences but that he also knew other teachers who could take a subject full of thrilling, breath taking experiences and teach it so it became as uninteresting and confusing as the proverbial "Greek." Perhaps no one subject is more abundant with thrilling adventures than geography yet it is often abused, made confused and uninteresting for pupils. In the field of geography our teachers should be skilled guides working toward the end of aiding the pupils to see the country or continent studied as a whole picture, not just a series of unrelated facts. The teaching of facts has too long been emphasized in geography classes. Modern geography should be concerned with the *why* factor of the human-geographic relationship and not with the what and where as pure isolated facts. Facts, which too often are meaningless and unrelated, will be learned and understood during the process of solving the *why* factor. Certain basic understandings, abilities, and knowledge should be acquired from a course in geography. These ought to be clear in the teacher's mind and he should point his course in that direction. These basic understandings and abilities should include the following: The comprehension of human-geographic relationships, the understanding of international and intercontinental relationships, the understanding and appreciation of the direct relationship of our natural resources to human welfare, the development of thinking and initiative, and the knowledge of and how to use sources of geographic data.

GOALS FOR GEOGRAPHY

Let us consider these above mentioned goals. First, it is important that pupils have a comprehension of human-geographic relationships. Pupils should be aided in the formation of judgments as to the *why* of these relationships; why people living in certain climates and parts of the world act, live, believe and earn a livelihood as they do. The facts so often acquired by time wasting drill will now be learned during the process of solving the *why* factor. Pupils should be guided as they study various lands to look for and discern the effects upon people of certain geographical surround-

ings—what various climates and natural environment will do to people and cause them to do, why some people are always backward and others progressive, why some races and nations are troublesome and warlike and others peaceful. Even remedies for certain conditions observed could be searched for in the light of science or education. Perhaps if people understood the climatic and geographic handicaps that certain races and nations are forced to bear because of the mere accident of birth and the resulting effect of this environment upon them, there would be more tolerance, understanding, helpfulness, and peace amongst the peoples of the world.

As a second goal, pupils should have an understanding of international and intercontinental relationships. They should be led to make comparisons between the conditions observed in countries or continents already acquainted with and those in countries or continents being studied. Pupils ought to know how the surface features of one continent compare with those of another and the resulting effects, if any, upon the development of these continents. Why one country is probably rich in various natural resources and another is not and the effects of this upon the progress of these countries. Why some countries have always been bitter enemies and others have been allies for centuries. Why some parts of the world give promise of great economic importance in the future and other parts give evidence of a gradual retrogression. If students of today had a sympathetic understanding of the problems, assets, and liabilities of the various nations, a great deal of world strife in years to come could be eliminated.

The relationship of natural resources to human welfare should be a third objective and introduces the subject of conservation. Conservation should be an important part of the course of study in geography. Pupils should be led to discover and know why human welfare is so closely related to natural resources. To accomplish this a plan of study of three divisions might be set up as follows: The development of an appreciation of how much people are dependent on the soil, water and mineral resources, and wild life; the development of understandings of how necessary it is to conserve natural resources in order to maintain national prosperity and insure the welfare of future generations; the development of procedures necessary to preserve and conserve natural resources and thus provide for the welfare of mankind. These appreciations and understandings undoubtedly can be developed and created most

adequately by means of field trips and outdoor as well as indoor problem-projects.

Again, modern education recognizes that perhaps its most important task in a democracy is to teach youth how to think clearly both in a group and independently. Along with this must go the training in how to secure data from which to base their reasoning. Good citizenship in a democracy is expressed by the intelligent use of the right to vote. If democracy is to endure, the citizenry must be able to think things out for themselves. Our courses should afford opportunities to develop thinkers. The study of geography affords excellent occasions to accomplish this thru the use of projects and problems which require wide reading and much thinking to solve.

In thinking of the development of initiative as another goal of geography, we cannot help but realize that the schools of today must provide opportunities for young people to learn how to do as well as to know. To properly exercise the rights of citizenship in a democracy and to insure the permanency of democracy, our citizens must have the ability to originate or lead out when necessary. Thus initiative on the part of our pupils should also be developed and encouraged. In a geography course this can be attained by guiding pupils to form and solve their own problems and by encouraging them to search various sources for information even going beyond what the task at hand requires. Of course the source material will need to be gathered first by the teacher and conveniently placed for the pupils to use. If genuinely motivated the pupils will not need to be prodded to do extra reading but there are always a few who need to be led to discover the thrill of finding information that no one else knows about. This search for pertinent information is of further value in that it provides an opportunity to teach youth how to weigh evidence and develop critical evaluation.

THE PROBLEM METHOD

The problem method is perhaps one of the best procedures to accomplish the above goals for a geography course. There are various types of the problem method but the one that the writer has been using for several years and finds most effective is built from a study of pupils and is based on modern psychology and the laws of learning. This method consists of a series of activities by the pupils under the guidance of the teacher.

Naturally the first step in introducing any new study is one of exploration and ascertainment by the teacher of the pupils' background and knowledge as related to the new phase of work. In the light of what the exploration reveals, the material for a new problem is sketched for the pupils by the teacher in a presentation talk. This presentation is designed to motivate and arouse a problem in the minds of the pupils. To be efficacious the presentation must be dynamic and intriguing. In this problem method the problems always come from what the pupils are interested in. The teacher in the presentation can arouse interest in the study concerned thru the wise use or display of illustrative materials of which there are many if only the time is taken to collect them. Discussion and questions aroused from this display and presentation invariably create interest and problems in the minds of the pupils and open the way for the pupils to be guided into the organization of their own problem.

The next step is the organization of the problem. The best problem is generally one built from current or practical problems. For instance, a general problem for the study of Europe that the pupils could be guided to organize might be: "Continental Europe today is what it has been for centuries—an international sorespot. This hasn't been due to chance. What are the fundamental situations behind the recurrent crises in this region?" Another problem that the pupils might formulate on South America could be: "South America has long been regarded as a backward continent, yet today many European nations and the United States are feverishly establishing regular air service between South America and their respective countries as well as investing much of their surplus capital there. Why is this so? What is there in South America to justify this? Is it a safe enterprise?" In such a problem facts will be learned incidentally as they are used to solve the problem. Then, too, each pupil will have been challenged to think. The more modern and practical the problem the stronger will be this challenge and the more avid will be his interest and desire to find a solution. Experience has proven that a wide degree of knowledge and a deep understanding is gained by pupils because of solving their own up-to-the-minute problems. After the problem is formed, the pupils are ready to organize a procedure by which to solve it. This may be in the form of a battery of pertinent questions arranged in proper sequence and built from the key words in the problem. If the problem

is a good one such questions naturally arise in the minds of the pupils.

SUPERVISED STUDY AND RESEARCH

After the problem has been formulated and the attack planned, the next procedure is that of assimilation which necessarily includes much supervised study. The pupils now go about gathering data and information called for by the problem and questions. This involves much reading and may take one or more days depending on the scope of the problem. Various source material is of course desirable and the teacher can give excellent guidance here. Too much cannot be said on the value of wide reading and getting the viewpoint of various authorities. Of course the more inquiring minds will do wider reading than the weaker pupils. This extensive reading should be encouraged but not required and it may also make provision for the individual differences which occur in every class. This period of assimilation is most effective if the pupils are guided to assume the viewpoint and method of a lawyer or a detective who is searching for the solution of some crime or mystery and files away the data for future use as it is obtained. It is important to note here that this also provides excellent elementary training in research. Too much cannot be said about the values to be derived from research but this is a phase of training very often omitted from our school courses.

DISCUSSION IS IMPORTANT

The next activity is that of discussion or socialized recitation, a procedure which necessarily is part of this problem method. At this time the pupils present their findings and the group as a whole forms final conclusions regarding the problem. All pupils are expected to take part and talk on the various phases of the problem but no one is called upon unless he volunteers. Experience has shown that if the laws of effect and readiness are adhered to at this point, greater interest and participation is gradually attained. In order to eliminate embarrassment and defeatism, pupils are encouraged to volunteer for main talks and additions. Here in the discussion period the pupils, who do more study and search further for information than others do, can give evidence of such by means of special reports and making additions to what others have to say. Of course they should be justly rewarded. Incidentally, socialized discussion should be so developed as to give excellent training

in the ability to express one's self effectively and correctly. Perhaps, too, one of the finest outcomes of this discussion period is that of cultivating the ability to think with others and to make summaries and draw conclusions after each main point of discussion.

Testing

The final procedure is that of testing. The objective is not just to "test" as of old but to help the pupils crystallize their thoughts on the problem into a wholeness. A good test is the solving of a small problem that pertains to the one just discussed. Another is the giving of some objective test such as the completion. The testing purpose should be three fold: to help the pupils see the solution of the problem as a whole picture; to stimulate the thinking processes; and to give credit where credit is due.

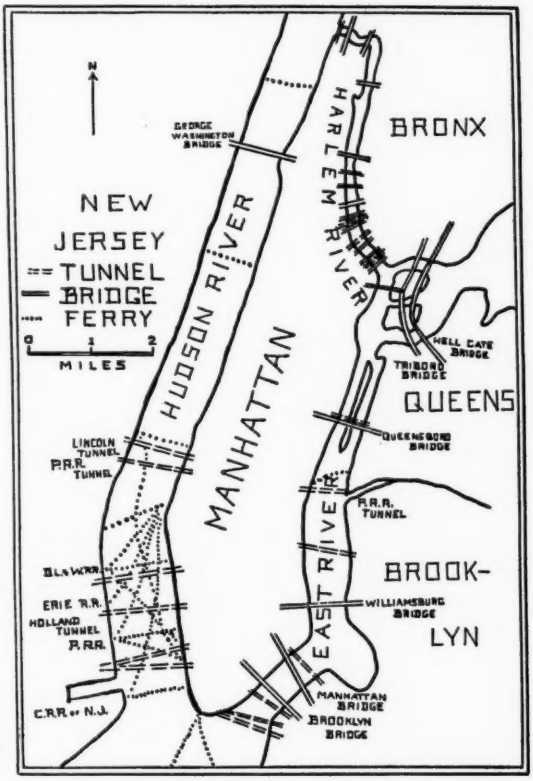
Summary

In conclusion, experience has proved that this method is an excellent vehicle in the developing of geographical understandings and knowledge. It is not only an interesting procedure for the pupils but is a saver to some extent of teacher time and energy. The burden of the work is placed where it belongs—with the pupils. The teacher plans the course and guides in its unfolding but the pupils organize it into problems that interest them and then proceed in the solution. Whatever method we use, our course of study for geography should include procedures for attaining and developing: an understanding of human-geographic relationships, an understanding of international and intercontinental relationships, an appreciation and understanding of the relationship of natural resources to human welfare, good thinking and reasoning, the initiative to search things out for one's self, and the knowledge of where to find and how to use trusted source material.

THE TYPES OF RIVER CROSSINGS AROUND MANHATTAN ISLAND

HAROLD M. MAYER
University of Chicago

Vital to Manhattan, the most densely populated island in the world, are the river crossings. A residential population of slightly less than two million is increased at least three-fold during each business day. Thus each day the rivers surrounding the island are crossed eight million times, mainly during two hours in the morning and evening. In addition, every ton of freight moving in or out of Manhattan must cross one of the three rivers which border the island. All this is accomplished by means of approximately 17 ferryboat lines, 21 bridges, the same number of tunnels, and railway car floats, which discharge at 50 terminals situated along the periphery of the island.



Sketch map of the river crossings around Manhattan Island

Quite apart from the difficulties and costs of construction, each type of river crossing possesses a number of advantages and disadvantages in operation, depending principally upon the types of conveyances using it, and upon the conditions of the rivers and their banks. The conveyances include surface railway cars, rapid transit subway and elevated trains, automobiles, truck and busses, freight cars, and electrically operated passenger trains of trunk line railroads. The rivers are the Hudson (or North) River on the west, the East River on the east, and the Harlem River on the east and north. The Hudson is one mile wide, the East River is about half

that width, and the Harlem varies in width from 500 to 1000 feet. The crossings of the first two must be designed to provide clear channels of sufficient depth, width, and vertical clearance for the largest ocean vessels.

FERRIES AND CAR-FLOATS

Ferries and car-floats are the only forms of river crossings which do not have a permanent right-of-way that may be used by a vehicle or pedestrian at any time desired. There is a lack of continuity of operation. This results in delays on shore awaiting the arrival of vessels, in further delays for loading and discharging, and in great congestion on the streets immediately after discharging. Including these delays, the average Hudson River ferry crossing occupies about thirty minutes. Furthermore, the ferry schedules lack dependability, because they are subject to weather conditions, tides, and delays due to incoming and outgoing steamships. In addition, the capacity of the vessels is quite limited, and most of the peak-hour traffic cannot use them.

On the other hand, ferries have several distinct advantages. They are the only forms of river crossings which are themselves mobile. Consequently, if it is desired to replace a route by another, the ferries may almost immediately be transferred to the new route, awaiting only the construction of relatively inexpensive landing slips. The ferryboat represents the least expensive and the most flexible, even if slowest, form of river crossing. Consequently, it is best adapted to two situations where bridge or tunnel construction is not economically justifiable: first, where, in spite of dense traffic, natural obstacles such as the width of the river, as on the lower Hudson, make the cost of construction high; and second, where the traffic is relatively light and does not justify provision of an expensive permanent way.

Car-floats are barges, fitted with railroad tracks and moved by tugboats. The freight cars entering Manhattan, except across the narrow Harlem River from the north, are floated to the railway car-float terminals, about 50 in number, located along the edge of the island. The advantages are much the same as for passenger ferries: low cost and flexibility. With their use, the rivers form, in effect, a belt railway around the island. The railroads terminating on the New Jersey shore have access to the numerous float-terminals on Manhattan Island. This is especially important because of the impossibility of constructing any other kind of river crossing for

the tremendous freight traffic, and because the use of car-floats eliminates the necessity for extensive freight yards on the valuable land of Manhattan.

BRIDGES

The great advantage of bridges over ferries lies in the fact that they provide a permanent right-of-way, available at all times. There are no delays resulting from loading or discharging, from changes in tide, from weather conditions, or, in the case of fixed-span bridges, from river traffic. Bridges have almost entirely replaced ferries across the East River. Their capacity is many times greater than that of the ferries which they replaced. Rapid transit lines cross the bridges, in some cases with four tracks, and the trains move almost as easily as on land.

But there are several disadvantages of bridges which result from the dense traffic and intensive land utilization of New York. In the first place, clearance of at least 150 to 200 feet must be provided over the Hudson and East rivers to permit the largest ocean-going vessels to pass underneath. The construction of low movable-span bridges is practically impossible because of the width of the navigable channels. In the second place, in order to provide such clearances over the river without prohibitive grades on the bridge roadways, the approaches must rise very gradually. Since the land surface is nearly at river level, these approaches begin several thousand feet inland. They remove from other productive use several city blocks, and depreciate land values in the area between the end of the approach and the river bank. Finally, because of the space which they occupy, only one approach is usually provided at each end of a bridge in New York. All of the vehicular traffic is thus concentrated on one street leading to the bridge end.

The Harlem River is much narrower than either the East or Hudson rivers, and is navigated only at relatively infrequent intervals. Consequently, movable swing-span bridges are there the most common type, since high spans need not be provided. These movable bridges are low, thereby making possible the construction of numerous approaches. The traffic to and from the bridge ends is therefore more widely distributed over the land.

TUNNELS

Tunnels are the newest and most expensive type of river crossing.

The advantages of tunnels are several. In the first place, the

principal method of transit in New York City is the subway. Tunnels furnish a crossing under the river at levels most near those of the subway under land, thereby resulting in a minimum of gradient in the river crossing. Most of the subway lines cross all three rivers in tunnels, while those which cross the East River over the bridges operate on much slower schedule because of the steep grades in approaching the high spans from an underground level, and because of the vibration of the bridge as the trains move across. In the second place, the vehicular traffic at the ends of the tunnels, as in the case of those under the Hudson River, may be distributed over a wide land area by means of several approaches, which, being largely underground, do not conflict seriously with other forms of land use. Finally, tunnels do not produce depreciated land values in the area between their entrances and the river bank as do bridges.

Even aside from the high cost in money and lives of their construction, tunnels are not entirely replacing bridges and ferries because of several inherent disadvantages. The principal operational disadvantage is the fact that a tunnel may be safely used by only one mode of transportation, while bridges are commonly used by both automobiles and rapid transit lines simply by carrying two separate roadways on the span. Then too, vehicular tunnels must be provided with ventilating equipment to remove the exhaust gases. This operation is a continual source of expense. The railroads entering Manhattan thru tunnels must be electrified, making necessary elaborate power plants and transmission equipment. All of the steam lines from the west terminate on the New Jersey side of the Hudson River, and maintain fleets of car floats, tugs, and ferries in order to serve Manhattan Island.

CONCLUSION

The ferries are declining in relative importance because they are not able to carry dense traffic without delays. Bridges and tunnels are rapidly increasing both in number and in size. The choice between bridge and tunnel for a new river crossing depends upon the width of the river, the depth and character of its bottom, the land available for anchorages and approaches, the kind and amount of river traffic, and the kind and amount of the traffic which is to cross the river.

ADIOS FOR MEXICO

A Social Studies Unit for the Third Grade

MARY L. HILEMAN
State Teachers College, Peru, Nebraska

Do you sometimes rebel against the traditional Indians, the quaint Dutch, and the colorful Japanese? We felt that way not long ago in the third grade of our College Training School; and so by waving the magic wand that school teachers have in common with fairy godmothers, we went to Mexico. Recent developments in Europe and the Far East, as well as in the Lima Conference, have made us more conscious of our neighbors to the south and we are realizing that the peoples of the Latin American countries are as interesting and worth while as those to be found in any other corner of the world.

In organizing our Mexican unit we discussed, first of all, what we hoped to accomplish thru such a study. We realized that for third grade children our aims could not be too technical. By the process of elimination we finally set up the following goals which we hoped to accomplish:

1. To create a friendly feeling toward our neighbor country of Mexico.
2. To cultivate an interest in and respect for its beauties, its national traditions, and its people.
3. To find out how the children live, work and play.

As our next step we talked over our resources that we would be able to use in the development of our study. Our list of assets included:

1. Two recent textbooks with Mexican material worked out on the third grade level.
2. Several very interesting books of fiction on Mexico for younger children.
3. Mexican pictures.
4. A knowledge of Spanish life from previous school work.
5. A small window cacti garden.
6. The present fad for Mexican designs in dress material, pottery, etc.
7. Several children in the class with rather pronounced artistic ability.
8. Mexican curios that we would be able to borrow from homes.
9. Travel experiences of several people in the community.
10. A student teacher who had taught Mexican children for several years down on the border and who possessed a valuable collection of Mexican articles.

A general outline was then worked out to be used as a guide for the teachers in charge.

THE APPROACH

Several Mexican articles placed at various places in the room acted as teasers and brought forth questions from the children. Mexico was pointed out on the wall map and a border of Mexican pictures was put up to lend atmosphere.

THE PROCEDURE

The pupils and teachers told or read aloud stories about Mexican children. A Mexican reading corner was a very popular spot in the room. Rapid readers visited the corner and did additional reading whenever time permitted. During class time the children reported on stories read silently and informal dramatizations were frequently given. They wrote original stories about Mexico and these were later bound into individual books. Vocabularies increased constantly and many new words were added to the list of words we could spell. The children greatly enjoyed learning a few Mexican words and using them in conversation.

A part of each day was spent in hand crafts. The children drew posters with colored chalk free-hand on large sheets of print paper. They enameled lids from peanut butter jars and decorated them with Mexican designs for ice-tea coasters. They made Mexican flower pot holders with raffia and beads. We chose two designs and transferred them to block prints. These blocks were used to print unbleached luncheon sets for Christmas gifts.

The boys especially enjoyed building a Mexican shack. They constructed a frame-work of strips of lath 4′ by 6′ and stretched heavy cords around the frame at 12″ intervals. The girls cut large imitation palm leaves from brown wrapping paper and wove them in and out between the cords until the shack was covered.

An ever-increasing collection of Mexican articles tended to keep the class interested and enthusiastic. The children also enjoyed getting first-hand information from people who had visited Mexico.

CULMINATING ACTIVITY

At the conclusion of our study the children held a Mexican exhibit. The exhibit was advertised by means of posters which announced the place, time, and the admission charge of one cent. Children, wearing guide badges met the visitors at the door and escorted them around to inspect the live horned toads, dressed fleas, hand carved articles, feather pictures, and the numerous things which

had been collected and made during the study. A little girl in Mexican costume served fritos to the departing guests. Incidentally the study of arithmetic was correlated with our unit in the making of change and counting and spending our pennies.

GENERAL OUTLINE

I. The trip by bus over the new Pan-American Highway to Mexico City
  A. Reasons for highway
    1. To transport things between the countries and thus carry on trade
    2. To make it possible for the people of Mexico and the United States to visit each other and get better acquainted
  B. The distance
  C. The cost of the trip
  D. What we will need to take along
  E. What we will see along the way

II. The country
  A. Location
  B. Size compared to Nebraska
  C. Surface features
    1. Sea coast
    2. Mountains—Iztaccihuatl and Popocatepetl (Legends of their origin told)
  D. Climate
  E. Resources—Oil and precious minerals
  F. Beautiful scenery
  G. Government

III. The Mexican people
  A. Mixture of Spanish, Indian, and in some cases Negro
  B. Appearance
    Dark complexioned, sturdy
  C. Clothing
    1. Varies from elaborate to very poor
    2. Like bright colors
  D. Food
    1. Fresh tropical and semi-tropical fruits
    2. Like hot foods and relishes
    3. Favorite dishes include frijoles, tortillas, fritos, chili, etc.
  E. Homes
    1. Rich live in beautiful homes
      a. Houses built right on street with patio in rear
      b. Have beautiful flower gardens
    2. Poor live in small houses, frequently huts or shacks
      Also have beautiful flowers
  F. Customs
    1. The afternoon siesta
    2. The fiestas
    3. Church and religious festivals
    4. The bull fight

IV. Mexico City
  A. Story of its settlement

B. Cathedrals and public buildings
C. The floating gardens

MEXICAN SONG

TUNE—*Juanita*

Far in the South Land
Lies our neighbor Mexico,
Land of the sunshine
Where the palm trees grow.
Land of rugged mountains
Land of bright flower bloom.
There warm ocean breezes
Spread their sweet perfume.
Mexico, fair Mexico,
With your flow'rs and mountains grand
Mexico, fair Mexico,
You're our neighbor land.

There friendly people
Live in shack or palace fine.
Wear large sombreroes,
And on rare fruits dine.
Land of the fiesta,
Land of music and of fun,
There the brown-eyed children
Frolic when work's done.
Mexico, dear Mexico,
With your song that never ends,
Mexico, dear Mexico,
Let us all be friends.

OUTCOMES

In looking back over our study of Mexico we felt that the following outcomes were achieved.

1. The children and teachers gained much in working together in happy, cooperative activities. A way was provided for each child to contribute according to his interest and ability.
2. A tolerant, friendly attitude was established toward our neighbor country. The children no longer feel that Mexicans are queer foreigners, but neighbors who are very much like us.
3. We now appreciate the fact that we who live in the United States are not the only Americans and that the other countries of the western hemisphere have as rich a history, scenery that is as beautiful, and people who are as interesting and worthwhile as those of our own land.

4. A lasting impression was made as to the part a highway can play in the exchange of ideas and trade. The children seemed to grasp the idea that a road can do much to promote the feeling of peace and good-will between nations and I am sure the pupils are all looking forward to traveling some day over this highway to visit their friends south of the Rio Grande.

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THE DEVELOPMENT OF THE PEPPER INDUSTRY OF LOUISIANA

HARRY J. CHATTERTON
Southwestern Louisiana Institute, Lafayette, Louisiana

The peppers grown in South Louisiana are of the hot red type and belong to the Solanceae family and to the genus Capsicum. The varieties grown are tabasco, sport, cayenne and chili peppers. Altho different in type they belong to a single species, Capsicum frutescens, as proven by the cross pollination work of Julian C. Miller, head of horticultural research at Louisiana State University. The peppers belonging to the genus Capsicum are native to Central and South America. Since the coming of the white man, they have been distributed to all parts of the world.

Red peppers have been grown in Louisiana for over a century. Prior to the Civil War, almost every farm home and plantation grew its supply for use in seasoning foods and for use in medicines for both man and beast. They were used more extensively in the French and Spanish section of South Louisiana where the meats, fish and other foods are highly seasoned. Today, French cooking, for which New Orleans and South Louisiana are so famous, owes much of its reputation to the many sauces and peppers which are produced from the various types of red pepper in Southwest Louisiana centering around the cities of New Iberia, Lafayette, and St. Martinville.

The original commercial pepper industry was developed near New Iberia from the use of the tabasco pepper, the smallest of the peppers grown. The account of the early development of this industry is interesting. In 1852, a man by the name of Gleason (who had been with General Scott during the capture of Mexico City in 1847 and who remained in Mexico after the close of the war) came to New Orleans and while there gave to Mr. E. McIlhenny the seeds of some peppers, which he said had an especially fine flavor and grew in the State of Tabasco, Mexico. These pepper seeds were planted by Mr. McIlhenny at the family plantation at Avery Island near New Iberia. The quality of the peppers was so good that they were grown each year in the garden for home seasoning. During the Civil war, the McIlhenny family was banished from their home. Upon returning home after the War, the tabasco pepper bushes were found to be growing. As a result of the War, the McIlhenny family was financially ruined and being without funds with which

to buy the things that help to make food tasty, Mr. McIlhenny began experimenting with making condiments from herbs and peppers found growing about the old home. Among the plants that had survived during his absence were some pepper bushes like those that grew from the seed Gleason had given him. With the pulp of these peppers as a base, he made a hot aromatic sauce for table use and gave some of it to his friends. As a result of encouragement of friends, Mr. McIlhenny began to prepare Tabasco sauce put up in New Iberia, Louisiana for sale to the public. From a small beginning the Tabasco sauce industry grew in popularity until its distribution became world wide.

Tabasco sauce is prepared without cooking by the fermentation of the pulp for two years in oaken casks under a salt seal. After the fermentation, the paste is separated and mixed with compounding ingredients and bottled for market.

In 1898, a competing brand of sauce similar in nature to Tabasco began to be marketed under the trade name of "Trappey's Sauce Manufactured from Tabasco Pepper." Another competitor came on the market in 1910 which has been sold under the trade name of "Evangeline Sauce" manufactured from tabasco pepper.

At present the above type of sauce seems to be less in demand than formerly as the buying public is demanding cheaper hot sauces which are being manufactured on a very large scale from the sport and cayenne peppers. Two companies are producing a red pasty hot sauce from the sport pepper which retails for ten cents per bottle while another company produces a cheaper hot sauce from the large cayenne pepper which retails for five cents per bottle.

With the passage of time new uses were found for the tabasco pepper which include the bottling of the pepper both green and red with vinegar and sold in this form. It is also sold in the pickled form. During 1938, approximately 850 acres of tabasco peppers were produced.

The dried pepper industry of South Louisiana had its beginning in 1919 when Mr. A. A. Estillette began drying peppers on his farm for the Frank Tea and Spice Company. From a crude beginning where the peppers were dried in trays over fires, the industry has grown to such an extent that three companies have seven large steam and hot air dryers which dry the peppers as a continuous process.

After the peppers are dried, part of them are ground into a powder form at the Louisiana factories, packaged, and sold to the

public. The great bulk of the dried peppers are sacked and shipped in car lots to large food product concerns all over the United States and foreign countries. During 1938, 66 cars, averaging from 20,000 to 40,000 pounds, were produced by the three companies having dryers. The drying plants are located in New Iberia, Lafayette, and St. Martinville, Louisiana.

The peppers being used for drying are the sport and cayenne. The cayenne pepper produces a long red pod from six to nine inches

Fig. 1. Distribution of Louisiana Pepper Industry

in length. The sport pepper is said to have been produced as a result of a cross between the cayenne and the tabasco peppers. The pod of the sport is red when ripe and is over one and one-half inches in length.

Another branch of the pepper industry consists in placing peppers in barrels in salt brine to be later manufactured into the cheaper sauces or to be sold in the pickled form. During the season of 1938, there were approximately 3,000—fifty gallon barrels of tabasco, sport and cayenne peppers brined and some over six thousand barrels of chili peppers brined. All of the chili peppers are sold in the pickled form. The chili pepper was introduced by B. F. Trappey's Sons a few years ago from New Mexico and West Texas. It is a short thick hot pepper. During 1938, four hundred acres of the chili peppers were grown under contract for the above named company at New Iberia, Louisiana.

During the winter months, the different companies contract with the farmers and responsible tenants for the peppers of certain types from a prescribed number of acres. In this contract the farmer agrees to deliver the peppers to the factory from the opening of the season until frost, in the case of three companies, and until a certain quantity per acre has been delivered in the case of one company. The companies agree to pay a stipulated price for the

Fig. 2. Picking tabasco pepper near Avery Island, Louisiana. Photo by E. A. McIlhenny

peppers during the season as practically the whole pepper crop is sold in advance by the companies before the peppers are planted. During 1938, the companies paid the farmers the following prices:

Tabasco: 25¢ per gallon for red and 20¢ for green peppers.
Sport: 8¢ per gallon of 3 pounds per gallon.
Cayenne: $1.40 per 100 pounds.

Due to the large amount of labor involved in the picking or harvesting the peppers, the size of plantings per family averages about four acres, altho planters with tenants may grow as many as fifty acres on one farm.

Part of the seed is planted in hot frames in late February by some of the planters to be transplanted to the open field in April, while many farmers plant the seed during late March in the rows

where the plants are to grow in the open. The culture is similar to any other clean cultivated crop. After the plants begin bearing in the late July or early August fruiting is continuous until frost.

An average day's work for a pepper picker amounts to about 15 gallons of tabasco pepper, 40 gallons of sport and 300 pounds of cayenne pepper per day. Where a farmer hires his picking done, he pays 5 to 7¢ per gallon for the picking of tabasco peppers, 2¢ per gallon for sport and 30¢ per 100 pounds for cayenne pepper.

During 1938, the income per acre received by farmers for their pepper crop averaged from $70.00 to over $150.00. The quality of the soil has much to do with the production. In South Louisiana, the best production is secured on rich loam alluvial or terrace soils.

The total acreage of the different types of hot peppers grown during the 1938 season were: Tabasco, 850 acres; Sport, 1725 acres; Cayenne, 1525 acres; Chili, 400 acres, or a total of 4500 acres. This is by far the largest acreage of hot red peppers produced in any area of the United States. California, Arizona and New Mexico produce the chili peppers and there is some production of the hot peppers commercially at Wilson, Louisiana, in South Mississippi and in the coastal areas of North and South Carolina.

At each of the pepper factories, various other food products are processed or canned in order to give more regular work for the labor. The foods processed vary at different factories. Among the foods processed are okra, tomatoes, beets, sweet potatoes, chile beans, cucumber pickles and at one plant oysters and shrimp.

The question might be asked as to what are the factors responsible for the development of the hot pepper industry in South Louisiana. Chance was responsible for the start in a region having an eight months' growing season and a well distributed rainfall and large areas of rich loam soils which are a part of the former flood plains of the Mississippi River. The farmers have become proficient in pepper production while the factories have been alert in developing new products and extending the market.

The pepper products are marketed thru regular wholesale and brokerage channels. The horticultural division of the Louisiana Experiment Station has improved the varieties of pepper being grown thru selection and breeding work. As a result the quality of the peppers has been raised.

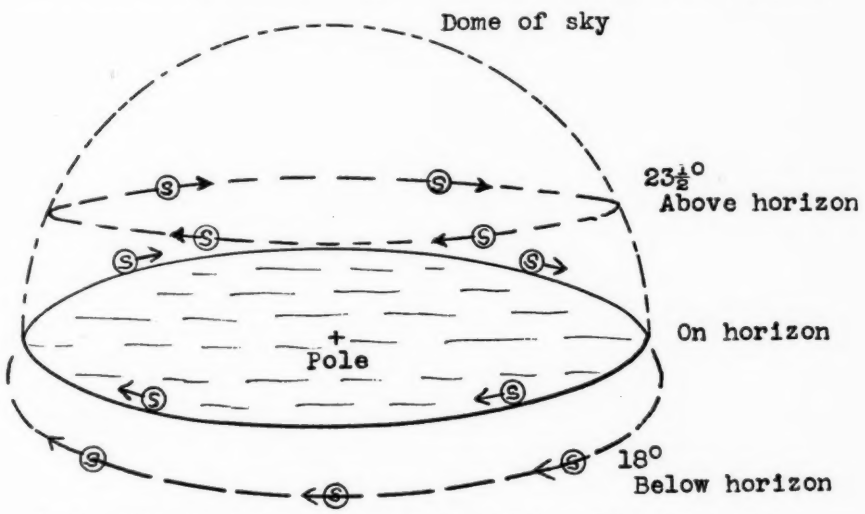
The writer wishes to express his thanks to Mr. E. A. McIlhenny for the account of the tabasco sauce; to Mr. A. A. Estillette of the Frank Tea and Spice Co., to Mr. Bulliard, owner of the Evangeline Pepper and Food Products Co.; to George and R. J.

Trappey of B. F. Trappey's Sons and to W. C. Kimbraugh, owner of the Lafayette Brokerage Co., for the statistical facts concerning the pepper industry. Also to Dr. Julian C. Miller, Head, Horticultural Research of Louisiana State University, for use of "A Genetic Study of some Qualitative and Quantitative Characters of the Genus Capsicum" and other facts.

"DAY" AND "NIGHT" IN POLAR AREAS

SAM T. BRATTON
University of Missouri

It is generally believed, and taught by some, that polar areas have six months day and six months night. This is not true, but it is true that for approximately six months, at the poles, the sun is visible and for the succeeding six months the sun is not visible.



Sun's position in relation to horizon at North Pole at different times during a year.
On horizon, about March 22 and September 22.
Above horizon, 23½°, June 21.
Below horizon, 18°, about December 1 and January 10.

In order to understand the light and dark periods at the pole it is necessary to recall that during the year the sun apparently moves north and south across the equator, reaching about 23½° north and south. Such movement is at the rate of about .26° per day (24 hrs.), but it not quite the same every day.

To visualize the light and dark conditions at the pole, as a re-

sult of the sun's north-south movement, let us assume we are living at the north pole.

On or about March 22 the sun is vertical at the equator, hence it is visible to us at the pole and is just on the horizon. On that day the sun will move completely around the horizon. On each succeeding day the sun will continue to circle the horizon, but will rise a little higher day by day for three months, or until about June 21. On this day the vertical rays of the noonday sun have reached their fartherest northward position, the Tropic of Cancer, 23½° N. Hence at the pole the sun will circle the horizon at an altitude of 23½°.

The sun now begins its southward journey. To us at the pole the sun continues its daily circling but drops lower and lower each day, until, on or about September 22 it has reached the horizon. Thus the sun has been above our polar horizon for a period of about six months, March 22 to September 22. After September the sun continues its daily circuit, but is now below our horizon; however, twilight continues until the circling sun, dropping about .26° each day, has dropped about 18° below the horizon. This requires about seventy days during which time our polar home has had twilight.

The sun, after twilight has disappeared, continues southward until it reaches its southernmost position, 23½° S., on or about December 21. It then begins the return journey. At our polar home no twilight from the returning circling sun will reach us until it has approached within some 18° of our horizon. Spring twilight now begins and grows brighter each day until in about seventy days the sun again appears on our horizon.

Between the end of the autumn twilight and the beginning of the spring twilight the sun has been "away" about fifty days. This is the "dark" period. But during this period the polar landscape is likely to be snow-covered, the stars shine, the moon is visible a part of the time, and there are likely to be frequent displays of the "Northern Lights."

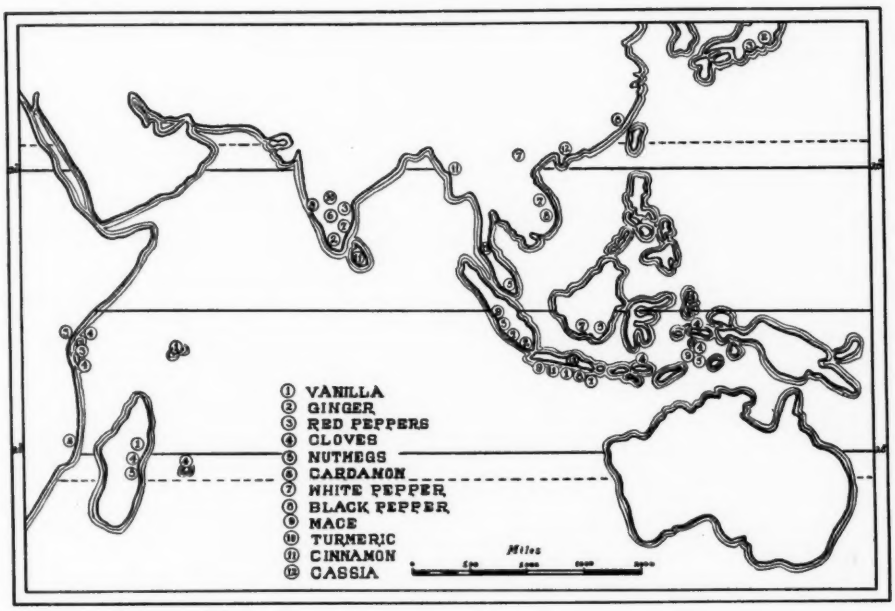
So, if living at the pole, we would have, during the year, six months visible sun preceded and followed by twilight periods of about two months each, or a total time of about ten months of "light." Our "dark" period would be only seven or eight weeks in length, and even then we would have the snow, the stars, the moon and the Aurora Borealis. It is not likely that "night" at the pole is ever as dark as most nights in the United States.

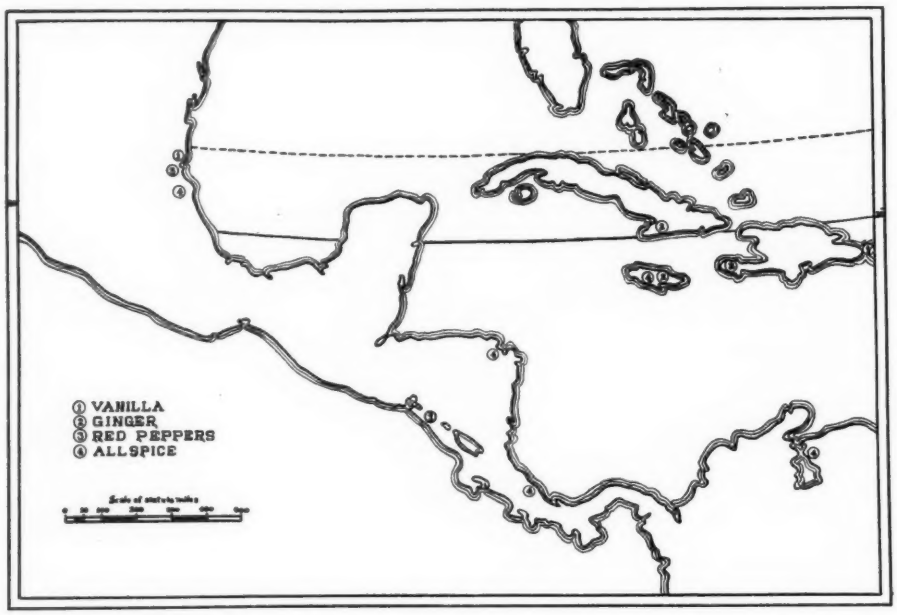
SPICES: A TEACHING TEST

E. RAY CASTO
Emory and Henry College

Underline the word or words in parentheses which properly complete the following sentences.

1. The pepper plant is a (tree, shrub, vine).
2. The principal producer of pepper is (Dutch Indies, Ceylon, Arabia).
3. The trade in pepper is dominated by the (Mexicans, Chinese, Russians).
4. Cloves are the dried (green leaves, flower buds, ripe fruits) of a tropical tree.
5. The clove tree is a native of (Cuba, Madagascar, Molucca).
6. During the seventeenth and eighteen centuries the (Dutch, English, French) had a monopoly on the trade in cloves.
7. The islands (Cuba and Haiti, Sumatra and Java, Zanzibar and Pemba) are the chief producers of cloves today.
8. The French produce cloves on their islands in the (Indian, Atlantic, Pacific) Ocean.
9. Cinnamon is the (heart wood, inner bark, outer bark) of a small tree.
10. (Madagascar, Ceylon, Sumatra) is the chief center of cinnamon production.
11. Cassia is (superior, equal, inferior) to commercial cinnamon.
12. The nutmeg is the product of a (vine, tree, shrub).
13. The nutmeg is produced mainly in the (East Indies, West Indies, Hawaii).
14. The nutmeg is (less, equally, more) popular today than in earlier centuries.
15. The vanilla plant is a (tree, shrub, vine).
16. (Chile, Mexico, Cuba) is a principal producer of vanilla.
17. Natural vanilla is (stronger, equal to, weaker) than synthetic vanilla.
18. Ginger is derived from the (seeds, stem, root-stalk) of a marginal tropic plant.
19. Chilies are produced in the (West Indies, Arabia, East Indies).
20. (New Zealand, Jamaica, Newfoundland) is a producer of ginger.
21. The (English, Portuguese, Spanish) were the first Europeans to sail to India in quest of spices.





22. (Spices, alcohol, sulphur) in early days served in the preservation of fish and meat for winter use.
23. The spice cargo of (Vasco da Gama, Marco Polo, Christopher Columbus) from India in 1497 yielded a profit of 6,000 per cent.
24. Temperate climates yield (cloves, mustard, nutmegs).
25. Allspice is the dried (leaves, roots, unripe fruit) of a tree.
26. Allspice is cultivated chiefly in (Java, Jamaica, Cuba).
27. Mace is the seed coat of the (clove, nutmeg, pepper).
28. Cardamons are produced in (Cuba, Java, Ceylon).
29. The berries of the black pepper are gathered when they (are green, begin to fall off the vine, begin to turn red).
30. White pepper is prepared from (fully ripened berries, dried berries, green berries).
31. One of Magellan's ships arrived at Spain in 1522 loaded with (nutmeg, cloves, pepper).
32. Cortez found the Mexicans flavoring chocolate with (vanilla, cinnamon, cloves).
33. At the time of the Crusades, spice traffic was dominated by (Jews, Christians, Moslems).
34. (Habana, Calcutta, Singapore) is an important mace port.
35. Much turmeric is shipped from (Colombo, Madras, Bombay).

KEY

1. vine
2. Dutch Indies
3. Chinese
4. flower buds
5. Molucca
6. Dutch
7. Zanzibar and Pemba
8. Indian
9. inner bark
10. Ceylon
11. inferior
12. tree
13. East Indies
14. less
15. vine
16. Mexico
17. weaker
18. root-stalk
19. West Indies
20. Jamaica
21. Portuguese
22. Spices
23. Vasco de Gama
24. mustard
25. unripe fruit
26. Jamaica
27. nutmeg
28. Ceylon
29. begin to turn red
30. fully ripened berries
31. cloves
32. vanilla
33. Moslems
34. Singapore
35. Madras

EDITORIAL NOTES AND NEWS

Such items as these are typical of the current news carried in the weekly issues of *Commerce Reports*. Some recent covers have featured excellent photographs of some outstanding commercial or industrial activity. The following are but a few items in current issues that might be interesting to your geography classes. Grace Line in June put in a five-day service from La Guira to New York; while a Japanese line put in a regular steamship connecton between La Guira, Buenos Aires, Santos, and Rio, the first direct line Venezuela has had with this part of South America. In the fiscal year ended June 30, 1939, 5903 ocean going commercial vessels passed thru the Panama Canal, the fourth highest year in the history of the Canal. The peak was in 1929 when transits numbered 6289. Siam as a name has been scrapped and Thailand is the substitute, according to the Siamese Legation in Washington. The word for Siamese now is Thai.

Food and Life is the title of the new 1939 Yearbook of the Department of Agriculture. The theme announced for that of 1940 is Farmers in a Changing World, while that of 1941 is Climate and Man.

According to Fruit Canners of the World (Bureau of Foreign and Domestic Commerce) approximately 75 million cases (basis 24 No. 2½ cans) of fruit were packed in the world's canneries in 1937. Addition of the United States pack of canned fruit juices raises the total to 95 million cases. About one-fifth entered international trade. Of the world production, the leading ranking areas are: Continental United States, 64.5%; Hawaii, 14.5%; British Malaya, 4.3%; Germany, 3.7%; Australia, 3.5%; Japan, 3.4%; Canada, 2.1%; and United Kingdom, 1.6%. The outstanding recent gains in canned fruit exports are in grapefruit sections and canned juices from the United States, pears and apples from Canada, and pineapples and mandarin-oranges from Japan. Hawaii is by far the leading pineapple canning area of the world, with British Malaya ranking second. The greatest variety of packs are made in the United States, followed by Australia. The United Kingdom shows a marked increase in canned fruit consumption. The United States exports of 7,800,000 cases in 1938 constituted an all-time record.

The Radio Section of the Department of the Interior is continuing to sponsor its weekly series of broadcasts on conservation, on Saturdays, at 1:30 P.M., E.S.T., over approximately one hundred Columbia stations.

The following are a few of the leaflets or pamphlets available, free or at nominal cost, to teachers. *Talks* (nominal cost) is the quarterly digest of topics broadcast over the Columbia Network. The National Broadcasting Company offers a monthly publication of its programs called *N.B.C. Presents. Geographic News Bulletins* (nominal cost) is published weekly during the school year by the National Geographic Society, Washington, D.C., and contains up-to-date news of discoveries, happenings, achievements in various parts of the world. Soil Conservation Service, U. S. Department of Agriculture, offers a host of excellent illustrated bulletins and charts (free). The revised list of these publications was issued last June. A similar set of publications is available, free, from the National Park Service, Department of the Interior. The daily weather map and

other Weather Bureau publications, and certain publications from the U. S. Departments of Commerce and of Agriculture, especially the current yearbooks, are invaluable to teachers and libraries.

The fall Association meeting of the New York State Geographical Association was held at Syracuse University where a series of papers and round table discussions were presented by a group of prominent geographers, several of whom have had travel, study, and teaching experiences in foreign fields. Eric H. Faigle, Chairman of the Association, taught during the past summer session in the University of British Columbia, Vancouver.

The Institute of Far Eastern Studies was again conducted last summer at the University of Michigan under the direction of Dr. Robert Burnett Hall of the geography department of the University of Michigan. The work in geography was presented by Dr. Hall and Dr. George B. Cressey, Professor of Geography, Syracuse University. The Institute is held under the auspices of the University of Michigan in conjunction with the Linguistic Institute and assisted by the American Council of Learned Societies. A similar program was offered in the Institute of Latin-American Studies, held under the auspices of the Committee on Latin-American Studies of the American Council of Leaned Societies, with the cooperation of the Rockefeller Foundation. Dr. Preston E James, Professor of Geography at the University of Michigan, was the Director and offered the work in geography.

Last July the U. S. Weather Bureau changed its way of sending weather observations by coded words to the use of numerals, an international arrangement used by stations all over the world. In this country the telegraph companies have agreed to transmit as many as five numerals to a word. Numeral codes permit the transmission of more detailed weather observations to the forecast centers.

According to the U. S. Department of Agriculture, men in W.P.A. crews planted field windbreaks in the Prairie States at the average rate of a tree a minute. In 1939, more than 42,000,000 trees in 4,500 miles of new windbreaks were planted. Since 1935 this brings the total planting to 127,000,000 trees in more than 11,000 miles. A mile of ten-row windbreak requires about 10,000 trees and shrubs, trees being planted about 6 feet apart in the rows and shrubs about 4 feet apart. Another phase of conservation which is being expanded is the construction of farm ponds in the Great Plains where streams and lakes are scarce. Besides furnishing water to livestock, properly managed ponds afford a home for wildlife which may have economic value. The Soil Conservation Service has constructed 2,126 ponds on 1,120,000 acres, or a pond to every 527 acres. Under the Water Facilities program of the U. S. Department of Agriculture, additional ponds will be developed in 21 counties in Colorado, Kansas, New Mexico, Oklahoma, and Texas.

Since New Mexico is to celebrate the Coronado Cuarto Centennial next summer, you may wish to receive the series of articles which the National Park Service, Department of the Interior, distributes free on topics relative to the area. One released in August dealt with the Basketmakers of the Four Corners region, where the states of Utah, Colorado, New Mexico, and Arizona meet.

GEOGRAPHICAL PUBLICATIONS

Ovid Miller McMillion. **New Alaska.** 216 pp., 25 illustrations, 4 folded maps, bibliography. Edwards Brothers, Ann Arbor, Mich. 1939.

New Alaska fills a long-felt need for a book presenting an authentic, comprehensive, interesting picture of our northern territory. The book is not limited to subjects of geographic nature but rather it discusses much of general interest. The following chapter titles indicate the scope of the work: I. Historical Background; II. The Natural Environment; III. Alaskans, Native and White; IV. Fisheries, the Bread of Alaska; V. Towns and Cities. Centers of Industry; VI. Minerals and Miners; VII. Reindeer, North America's New Tundra Industry; VII. Farming the Top O' the World; IX. Forests and Water Power, "America's Scandinavia; X. Transportation, A Study of Modes; XI. Furs and the Raising of Winter Clothing; XII. Alaska as a Summer Playground and Wild Life Refuge; XIII. Finance and Trade North of 54° 40'; XIV. Conclusion.

The Author of *New Alaska* spent several years in the territory. His intimate acquaintance with it has enabled him to put into his discussions a freshness of treatment, a vividness of portrayal, a sympathy in criticism and an assurance in his statements which lead the readers to overlook some imperfections in paragraph structure and some other rhetorical infelicities. Mr. McMillion speaks out boldly and backs up his statements with a wealth of well-chosen data.

The book probably will be used more than elsewhere as a library supplement to texts on North America. Adults, however, as well as pupils, will find *New Alaska* useful and interesting. Mr. McMillion points out clearly Alaska's dependence mostly on fish for income, its prospect for important forestry industries, the relatively subordinate position of gold and reindeer production, and much other useful information. An unusual feature of the book is the number of excellent large maps. Evidently the author sensed the need for large maps in presenting details of a territory of such large size.

WILLIAM J. BERRY

Western State Teachers College
Kalamazoo, Michigan

Clarence A. Mills. **Climatic and Weather Influences in Health and Disease: Medical Climatology.** 305 pp., 90 illustrations. Charles C Thomas, Springfield, Ill. 1939. $4.50.

C. A. Mills, Ph.D., M.D., professor of experimental medicine at the University of Cincinnati has become rather widely known as a medical specialist on climatic and weather influences on health, partly because of his 1934 book "Living with the Weather," but more because of widespread publicity received by some of his technical studies. The present book is a summary of his previous work together with mention of numerous studies by others. The evidence presented indicates that weather and climate influence health in ways that few people have suspected: for example acute appendicitis attacks, and their fatality are, on the average, closely correlated with temperature and air pressure. That resistance to infection is much greater at optimum temperatures than at those only a few degrees higher is demonstrated by carefully controlled experiments with mice in air-conditioned rooms. Dr. Mills quotes Ellsworth Huntington, as every worker in this field must, frequently and with appreciation. However, he has prepared an original world map of climate stimulation which departs appreciably from that prepared by Huntington. Moreover he points out, more than Huntington does, that the stimulating climates have rather serious health drawbacks, and that the enervating ones have certain advantages. He considers North Dakota to have the most climate stimulation in the

United States, and, south central Asia, and the Andes of South America, to surpass western Europe in this respect.

This book contains much which will stimulate thought along geographical lines. It can be read with enjoyment and profit by almost any alert high-school pupil. Teachers of geography can obtain useful illustrations of climate and weather influences.

STEPHEN S. VISHER

Indiana University

E. L. Thorndike. **Your City**. 200 pp. Harcourt, Brace & Co., N.Y. 1939. $2.00.

In this small volume, there is packed more information and more suggestive material concerning the comparative merit of cities than can be discovered by extensive reading. No student of urban geography can afford to miss it; all such students will profit greatly by a study of it; the city "boosters" will find in the analysis of city characteristics food for thought.

The idea of a G score (general goodness) of the cities of the United States (of 30,000 or over) based on thirty-seven items (first four concern health, others concern educational opportunities, public provisions for recreation, economic and social items, creature comforts, infrequency of certain diseases and so on) is presented and following, the cities are tabulated. Out of an ideal 1541 score, Pasadena heads the list at 1110 and the lowest score is 330. A discussion and expansion of the items of this score follow and the causes of the differences between one city and another are enlightening, and often startling.

Finally a shorter method of measuring a city—called a Ten-item city yard stick is introduced. The figures for this are the most available of city statistics and permit one to score one's city and locate its place among the cities of the United States. The purpose is not as much to find things to praise as to learn the weaknesses of the city and thereby improve it. Municipal improvement is a more desirable objective of clubs and organization than planning municipal slogans or boasting of its leadership. To date, no way of estimating a city's place among the cities of the country has been offered. In this volume there is a way—a well planned way and a very inclusive way. The book is worthy of careful study.

ROBERT M. BROWN

Rhode Island College of Education
Providence, Rhode Island

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Mr. Parson is Head of the Department of Geography, State Teachers College, Troy, Alabama. He was formerly a member of the geography staff of the Tennessee Valley Authority.

Making Geography Teaching Click. By W. C. Lucas 349

Mr. Lucas is a social science teacher in the public schools of Milwaukee. In January, 1938, he contributed "Problem Method in History" to the *Wisconsin Journal of Education.*

Types of River Crossings Around Manhattan Island. By Harold M. Mayer 355

At present Mr. Mayer is carrying on his graduate study for the doctorate at the University of Chicago. His special interests are urban development and transportation problems.

Adios for Mexico. A Social Studies Unit for the Third Grade. By Mary L. Hileman 359

Miss Hileman is Assistant Professor of Education and supervisor of student teachers in the third and fourth grades in the Training School, State Teachers College, Peru, Nebraska.

The Development of the Pepper Industry of Louisiana. By H. J. Chatterton 364

Mr. Chatterton is Head of the Department of Geography, Southwestern Louisiana Institute. He is especially interested in the geography of Louisiana and the Southern states.

"Day" and "Night" in Polar Areas. By Sam T. Bratton 369

Dr. Bratton is Professor of Geography at the University of Missouri and a frequent contributor to the JOURNAL. His interesting article, El Pacayal: A Coffee Finca in Guatemala appeared in February.

Spices: A Teaching Test. By E. Ray Casto 371

Dr. Casto is Head of the Department of Geography at Emory and Henry College. Several other aids to teaching, written by Dr. Casto, have been published in the JOURNAL this year.

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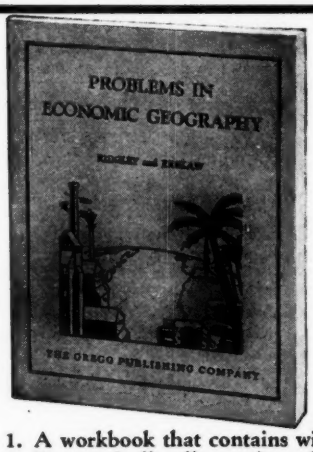

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The tentative program appeared in the November JOURNAL. The final program will be distributed at the meeting. The program indicates that a great variety of topics are included. Special features this year include demonstration lessons. This is your opportunity to see such work done, and to hear it discussed, by experts in the field of geographic education. There will also be a joint session and luncheon, with the Association of American Geographers. Extensive exhibits of maps and other geographical materials will be provided. These should be of value to all teachers. Every geography teacher should find something of interest and value at every session. Whether members of the Council or not, all who are interested in geographic education are invited to attend all sessions. Bring your friends and extend this invitation to all who may be interested.

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NEW PUBLICATIONS

S. W. Wooldridge and David L. Linton. **Transactions; and Structure, and Drainage in South-East England.** The Institute of Geographers. Publications Nos. 9 and 10. 124 pp. Illustrated. George Philip and Son, London. 1939.

A monograph in geomorphology, with a short introduction on the transactions of the Institute.

R. L. Spurlock. **Land Use Adjustment in the Spring Creek Area,** Campbell County, Wyoming. 15 pp. Illustrated. Soil Conservation Service, U. S. Dept. of Agriculture. 1939

The story, told in six exhibits, of how a typical Great Plains area is being placed on an economically sound basis of operation.

E. A. Norton. **Soil Conservation Survey Handbook.** Misc. Pub. No. 352. U. S. Dept. of Agriculture. 39 pp. Illustrated. Supt. of Documents, Washington, D.C. 1939. 10 cents

Procedure for making a soil conservation survey and instructions for mapping the major physical land features essential to the development of a wise land use program.

E. M. Rowalt. **Soil Defense of Range and Farm Lands in the Southwest.** Misc. Publication 338. Soil Conservation Service. 52 pp. Illustrated. Supt. of Documents. 1939. 10 cents

Hans G. Jepson. **Prevention and Control of Gullies.** Farmers Bulletin No. 1813. 60 pp. Illustrated. United States Department of Agriculture. Washington, D.C. 1939.

Henry M. Eakin. Revision by Carl B. Brown. **Silting of Reservoirs.** 165 pp. Illustrated. Technical Bulletin No. 524. United States Department of Agriculture. Washington, D.C. 1939. $1.00

Up to date information collected the past three years on reservoirs described in the original edition, and brief discussions on detailed surveys, as well as reconnaissance studies, and information on water-shed characteristics.

Geography for Today. Book III, North America and Asia. Edited by L. Dudley Stamp and L. S. Suggate. 404 pp. Illustrated. Longmans, Green and Co., N.Y. 1939. $1.75

Prepared by a committee representative of geography teachers, examiners, inspectors, as well as others doing various types of geographical work.

Lawrence S Williams. **Robin and Jean in the Netherlands and Belgium.** 241 pp. Illustrated. American Book Co., New York. 1939. 80 cents

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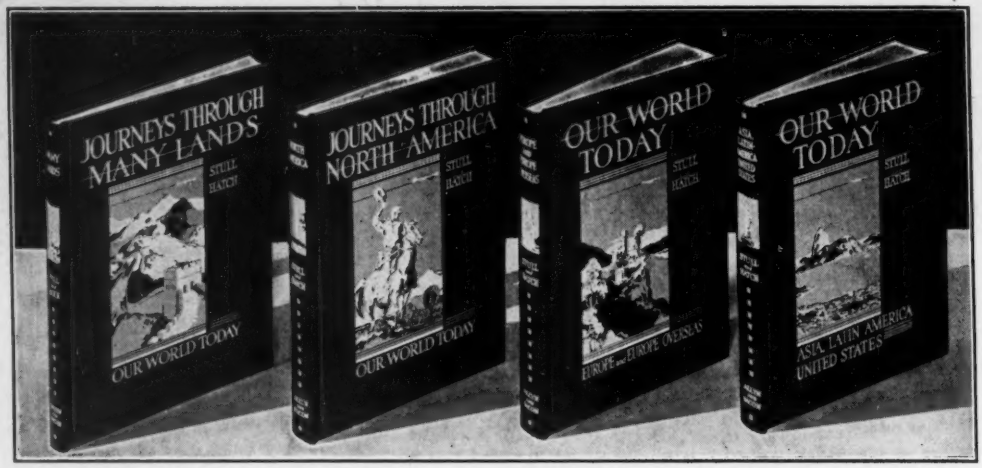

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